that the frequency v of Röntgen rays may be obtained from either of the equations

$$v - v_0 = \frac{T_v}{2.9} \times 10^{27} = \frac{T_m}{6} \times 10^{27},$$

where T_v is the mean energy and T_m the maximum energy of the electrons emitted when Röntgen rays fall on a metal. For these high frequencies v_0 may be neglected compared with v.

Our results are favorable to a theory of the photoelectric effect of the type of Einstein's[1] combined with the hypothesis that the difference in the work P for different substances is determined by the contact difference of potential.

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PRELIMINARY NOTE ON THE OCCURRENCE OF A SEX-LIMITED CHARACTER IN CATS[1]

The problems offered by so-called "sex-limited characters" have lately been attacked by several investigators who have found in many of the cases a possible explanation of the observed phenomena by considering one of the sexes a Mendelian homozygote for the "sex-producing" factor, while the other sex is considered a heterozygote.

The sex-producing factor is commonly designated by X, its absence by —. Thus one sex would be homozygous, XX, and the other would be heterozygous, X—. Certain cases have been found in which experimental results indicate that the female is homozygous, XX, while the male is heterozygous, X—, while in other cases the facts are best explained on the hypothesis that the female is heterozygous, the male homozygous. Interest increases as sex-limited characters are found in the higher animals, the inheritance of which follows one or the other of these formulæ.

It has long been known that "tortoise shell" (a blotching of black and yellow, or blue and cream) occurs in cats, in a vast majority of cases in the female sex. Doncaster[2] (1904) attempted to ascertain whether tortoise shell could be considered as a sex-limited character whose appearance conformed to the then existing hypotheses of sex-inheritance. He came to the conclusion that "tortoise" was merely the female form of heterozygote obtained in a cross between orange (yellow) and black animals. The male form of "heterozygote" was orange in certain crosses. Thus he found that (1) orange female × black male gives tortoise females and *orange* males, but the reciprocal cross (2) black female × orange male gives tortoise, *black* (and probably orange) sexes not stated. This last-named cross is crucial, for in it is contained the evidence that the male "heterozygotes" between orange and black are *not always orange, but may be black.* The writer has, in a very small way, carried on this cross. Thus four black females crossed with the same orange male have given a total of 15 young; of these 7 were males, *all being black,* and 8 were females, *all being tortoise; no "orange" animals appeared.* Here there is evidence that the cross of orange male × black female produces male offspring, *all of which are black,* while Doncaster's evidence shows the reciprocal cross to produce male offspring, *all of which are orange.*

We must, therefore, suppose a reversal of dominance to occur in the reciprocal crosses unless we can use the hypothesis of sex-limited inheritance.

If we adopt, tentatively, the hypothesis that the female is a homozygote, XX, and the male is a heterozygote, X—, and if we suppose that black, B, is always coupled with the sex-producing factor, X, we should conclude that the black female is of the gametic constitution, BB, and that the black male is of the composition B—.

The yellow male lacks the factor for the production of black pigment in the coat and is of the gametic composition Y—, while the

[1] *Ann. der Physik.*, Vol. 17, p. 146, 1905.

[1] From the Laboratory of Genetics, Bussey Institution.

[2] *Proc. Camb. Phil. Soc.*, XIII., Pt. I., p. 35, 1904.

yellow female is YY. The constitution of these four parent forms would then be: BB, black female; B —, black male; YY, yellow female; and Y —, yellow male.

If then we make the cross yellow male, Y —, $\times$ yellow female, YY, all the young should be yellow, one half being males and one half females. In this cross 5 young have been obtained, 3 males and 2 females, *all yellow*.

If we make the cross black female, BB, $\times$ yellow male, Y —, we have in F_1 two types of individuals, viz., BY, tortoise females, and B —, black male. Theoretically these two types should be formed in equal numbers; actually the tortoise females are 8, the black males 7. The reciprocal cross is yellow female, YY, $\times$ black male, B —; F_1 has two types of individuals, viz., BY, tortoise female, and Y —, yellow male. This expectation coincides with the facts observed by Doncaster. We have, however, an important cross under way which must be carried out more fully before the hypothesis, given above, can be considered as proved. This mating is: tortoise female, BY, $\times$ yellow male, Y —. The expected result is BY, tortoise females; YY, yellow females; B —, black males; and Y —, yellow males. One litter has been obtained from this cross; it contained one tortoise female, one black male and three yellows (dead), the sex of which was unfortunately undetermined before the caretaker discarded them. It is interesting to note that Doncaster cites this mating as producing "blacks, tortoises and oranges," though he does not record the sexes.

The cross tortoise female $\times$ black male has been recorded by Doncaster. It gave tortoise females, orange males, black females and black males. By the hypothesis here suggested this is to be expected. Thus tortoise female, BY, $\times$ black male, B —, should give BB, black females; B —, black males; Y —, yellow males; and BY, tortoise females.

Male "tortoise shells" occasionally occur, and it seems probable from their rarity that they are due to some distinct mutation such as that which produces tortoise guinea-pigs, and not to heterozygosis between black and yellow. Theoretically, if such were the case, tortoise females of a similar nature might be produced. Such animals would be indistinguishable externally from the common form of "tortoise," but would differ in gametic composition, and therefore in their behavior in crosses.

So far as first-hand evidence goes the observed experimental facts are best explained by the hypothesis outlined above, which considers the factor for black coat color in cats to be linked with the X element, and therefore to be sex limited. Doncaster's suggestion that tortoise is merely the female heterozygote obtained in crosses between yellow and black would not explain the fact that reciprocal crosses of black with yellow produce males differing in color, one cross producing black males, the reciprocal cross producing yellow males. Indeed the last-mentioned fact in itself makes the case unique among mammals. If, then, the hypothesis of "sex-limited" characters outlined above is found to be substantiated by the cross, tortoise female $\times$ yellow male, we shall have established a case of the same general character as those described by Morgan as occurring in *Drosophila*. Further experiments bearing upon the matter are in progress.

C. C. LITTLE

April 23, 1912

THE AMERICAN PHILOSOPHICAL SOCIETY

THE annual general meeting of the American Philosophical Society was held in the rooms of the society at Philadelphia, April 18 to 21 inclusive, and constituted perhaps the most notable series of sessions ever held by the society. The papers were all of a high order of merit and presented in many cases for the first time the results of original investigation by the authors.

The meeting was opened on Thursday afternoon, President W. W. Keen, LL.D., in the chair, when the following papers were read:

Some Former Members of the American Philosophical Society: THOMAS WILLING BALCH.

The writer said that besides Franklin, the founder of the society, Washington, Jefferson and Cleveland were members. Many other political